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(21)Application number : 09-275125 (71)Applicant : TOSHIBA CORP

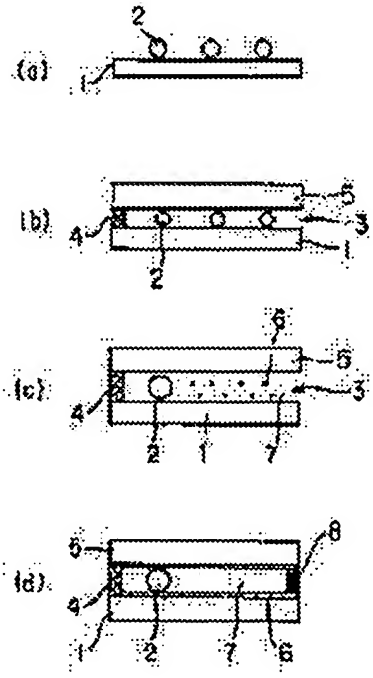
(22)Date of filing : 22.09.1997 (72)Inventor : MANABE MASUMI
FUKUOKA NOBUKO
MANABE ATSUYUKI
HADO HITOSHI

(54) LIQUID CRYSTAL DISPLAY ELEMENT AND PRODUCTION OF THE LIQUID CRYSTAL DISPLAY ELEMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To decrease the number of production stages, to improve a yield and to improve productivity.

SOLUTION: Glass substrates 1 and 5 formed with electrodes are assembled and a liquid crystal compsn. 7 contg. orienting assistants 6 consisting of a photosetting type high-polymer resin is filled from an injection port 3 into the spacing between the glass substrates 1 and 5. When the assembly is rested in this state, the orienting assistants 6 are attracted by the surface energy of the glass



substrates 1 and 5 and are adsorbed on the surfaces of the glass substrates 1 and 5. The orienting assistants are irradiated with UV rays from a prescribed angle, by which the oriented films having directivity in the prescribed direction are formed.

LEGAL STATUS

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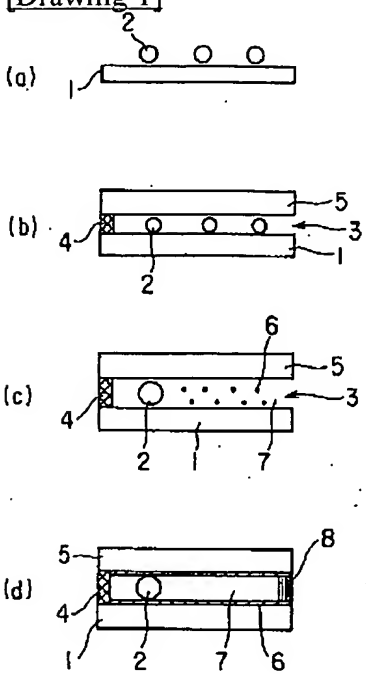
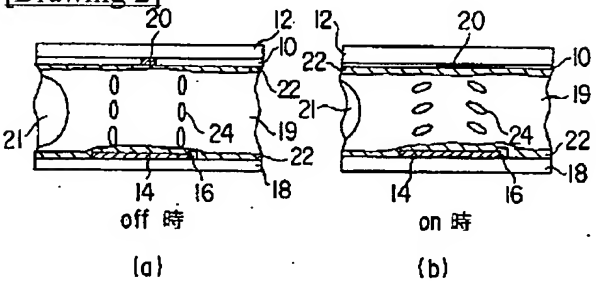
DRAWINGS

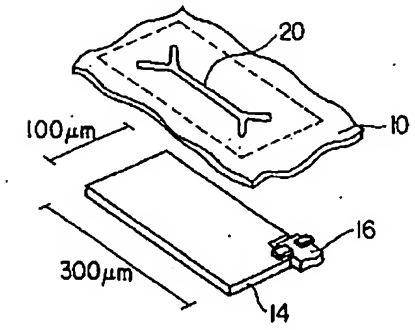
[Drawing 1]



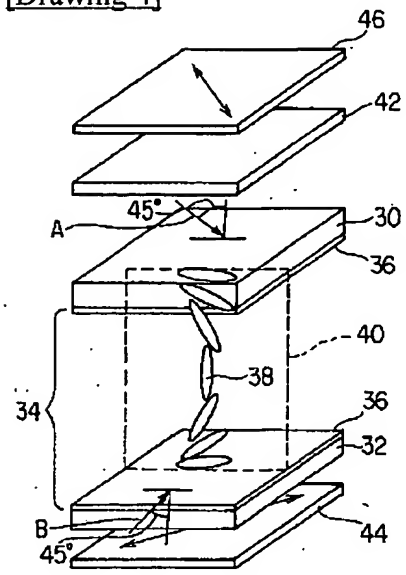
[Drawing 2]



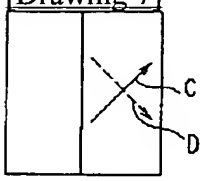
[Drawing 3]



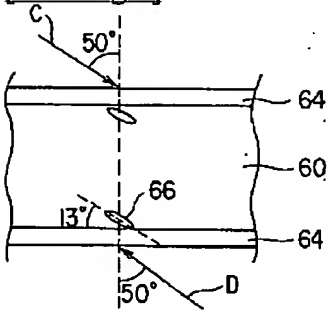
[Drawing 4]



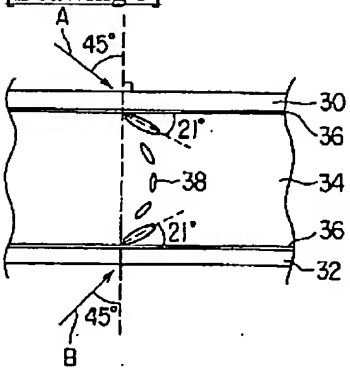
[Drawing 7]



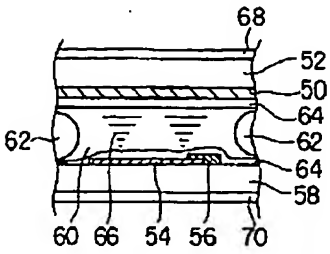
[Drawing 8]



[Drawing 5]



[Drawing 6]



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the liquid crystal display component which has improved productivity, and the manufacture approach of this liquid crystal display component.
[0002]
[Description of the Prior Art] In recent years, generally the liquid crystal display using the liquid crystal display component in the rotatory-polarization mode of an electric field effect mold and birefringence mode as what obtains the display of a thin light weight and a low power is used.
[0003] Since TN (Twisted Nematic) mold liquid crystal which has the molecular arrangement twisted 90 degrees among this rotatory-polarization mode liquid crystal display component shows a high contrast ratio by monochrome display theoretically, it is used for the clock, the calculator, etc. Moreover, this TN liquid crystal shows good gradation display nature, and since the speed of response is comparatively quick (dozens mses), it is applied to the active-matrix actuation method which used a simple matrix actuation method, TFT (thin film transistor), MIM (Metal Insulator Metal), etc. as the switching element, and possesses them for every pixel. Furthermore, this TN liquid crystal is applied to a liquid crystal television, OA equipment, etc. which can be displayed full color by combining with a light filter.
[0004] The STN (Super Twisted Nematic) mold liquid crystal which, on the other hand, has the molecular arrangement generally twisted 90 degrees or more as a birefringence mode liquid crystal display component, And there is SEB (Super Twisted Brefringence Effect) mold liquid crystal etc. Since it has a steep electro-optics property, switching elements, such as TFT and TFD (thin-film diode), are not allotted for every pixel, but structure of ** is simple and implementation of a big screen of it is easily enabled by time-sharing actuation using the electrode structure of the shape of a simple matrix with a cheap manufacturing cost.
[0005] Generally, these liquid crystal display components are manufactured as follows.
[0006] First, the opposite substrate equipped with the orientation film formed so that a common electrode and this common electrode might be covered, and the array substrate equipped with the orientation film formed so that two or more pixel electrodes arranged in the shape of a matrix and this pixel electrode might be covered are prepared. And after carrying out orientation processing of this opposite substrate and the array substrate by rubbing, respectively, a liquid crystal cell is formed by forming among both substrates, predetermined spacing, i.e., cel gap, carrying out opposite arrangement, and closing a perimeter. And a liquid crystal display component is manufactured by enclosing liquid crystal constituents, such as a cyclohexane system by which the chiral agent was added, an ester system, a biphenyl system, and a pyrimidine system, between both this substrate.
[0007]
[Problem(s) to be Solved by the Invention] However, the production process of a liquid crystal display component which was mentioned above has the problem that there are many routing counters and productivity is inferior. Moreover, at the process which carries out rubbing of the orientation film in the manufacture approach of a liquid crystal display component, in order to grind a substrate front face against cloth, the fiber of cloth and the orientation film can be shaved and it is easy to discharge dust, such as dregs, and it becomes the cause of dropping the yield and the problem of making productivity further inferior arises.
[0008] This invention aims at offering the liquid crystal display component which is made in order to solve the above-mentioned trouble, raises the yield while reducing the number of production processes, and can improve productivity, and the manufacture approach of this liquid crystal display component.
[0009]

[Means for Solving the Problem] This invention was made based on the above-mentioned trouble, and according to claim 1 A liquid crystal cell is formed by setting predetermined spacing and arranging two substrates which have an electrode in one principal plane of one [at least] substrate so that it may counter mutually. The manufacture approach of the liquid crystal display component characterized by what the liquid crystal constituent containing the orientation assistant which has the property of sticking to the front-face side of said substrate by the interaction with said substrate is enclosed for between said two substrates of this liquid crystal cell is offered.

[0010] According to claim 12, two substrates which have an electrode in one principal plane of one [at least] substrate In the liquid crystal display component which enclosed the liquid crystal constituent containing the orientation assistant which has the property of setting and arranging predetermined spacing so that it may counter mutually, and sticking to the front-face side of said substrate by the interaction with said substrate between said two substrates the residual orientation assistant which remains in said liquid crystal constituent, without adsorbing said substrate front face -- 0.003 - 1.5wt% -- the liquid crystal display component characterized by containing is offered.

[0011]

[Embodiment of the Invention] Hereafter, the gestalt of implementation of the liquid crystal display component which starts this invention with reference to a drawing, and the manufacture approach of this liquid crystal display component is explained to a detail.

[0012] The production process for manufacturing the liquid crystal display component of this invention is roughly shown in (a) of drawing 1 thru/or (d). According to the manufacture approach of the liquid crystal display component concerning this invention, the orientation film formation process which forms the orientation film on the substrate needed by the conventional production process, and the rubbing process which carries out rubbing processing of the orientation film in the predetermined direction become unnecessary, and the number of production processes can be reduced.

[0013] namely, one glass substrate 1 of the glass substrates as an array substrate with which the glass substrate or pixel electrode as an opposite substrate with which the counterelectrode was formed, the switching element, etc. were formed as shown in (a) of drawing 1 -- preparing -- the front face of this glass substrate 1 -- the spherical particle as a spacer 2 -- abbreviation -- it sprinkles by the uniform consistency.

[0014] And a sealant 4 is formed in the front face of a glass substrate 1 except for the inlet 3 of a liquid crystal constituent, and the glass substrate 5 of another side and one glass substrate 1 are made to rival by screen-stencil, as shown in (b) of drawing 1 . At this time, it is formed between a glass substrate 1 and a glass substrate 5 by the spacer 2, predetermined gap, i.e., cel gap.

[0015] And as shown in (c) of drawing 1 , the liquid crystal constituent 7 with which the photo-curing mold polymeric materials 6 as an orientation assistant were distributed by homogeneity is poured into the gap between glass substrates 1 and 5 from an inlet 3. As photo-curing mold polymeric materials 6 as an orientation assistant, although the photo-curing mold macromolecule distribution liquid crystal which uses the polymer dispersed liquid crystal called the photo-curing mold polyimide resin which used as the principal component the photo-curing mold acrylic resin which used acrylic resin as the principal component, the photo-curing mold epoxy resin which used the epoxy resin as the principal component, and polyimide resin, NCAP-PDLC (Polymer Dispersed Liquid Crystal), polymer network liquid crystal, etc. as a principal component is mentioned, it is not limited to these, for example.

[0016] And as shown in (d) of drawing 1 , an inlet 3 is closed with encapsulant 8 and a liquid crystal cell is formed. Thus, since the orientation assistant 6 can draw near to the front face of glass substrates 1 and 5 in general by the interaction with the front face of glass substrates 1 and 5, it adsorbs and it will be in a condition lower than adsorption before of the orientation assistant 6 by enclosing and leaving the liquid crystal constituent 7 containing the photo-curing mold polymeric materials 6 between a glass substrate 1 and a glass substrate 5, the surface energy, i.e., the affinity, of glass substrates 1 and 5, it becomes stability after the liquid crystal constituent 7 and the orientation assistant 6 have dissociated.

[0017] That is, since an orientation assistant is in a macromolecule condition, it is usually adsorbed on the surface of a glass substrate by activating the front face of a glass substrate with the affinity which becomes large. And the energy state of the front face of a glass substrate falls and is stable by an orientation assistant adsorbing on the surface of a glass substrate.

[0018] Thus, the liquid crystal constituent 7 and the orientation assistant 6 are made to separate spontaneously.

[0019] In addition, after enclosing the liquid crystal constituent 7 containing the orientation assistant 6, it is possible by impressing an electrical potential difference to a liquid crystal cell, heating cooling a liquid crystal cell, or irradiating ultraviolet rays at a liquid crystal cell etc. to accelerate and promote stabilization.
[0020] In order to strengthen the interaction between an orientation assistant and a glass substrate and to promote stabilization, it is important to rationalize the amount of the orientation assistant contained in a liquid crystal constituent and to raise the surface energy of a glass substrate, before pouring in a liquid crystal constituent.
[0021] As a content of the orientation assistant to a liquid crystal constituent, 0.01 - 5wt% is suitable. If less than this range, orientation will become instability, and if it exceeds this range, in case it will be hard coming to distribute the orientation assistant itself to homogeneity and it will enclose a liquid crystal constituent into a liquid crystal constituent, it cannot enclose with homogeneity, but it becomes the cause of orientation nonuniformity. Moreover, although there may be an orientation assistant which remains in a liquid crystal constituent after separation with enclosure and the liquid crystal constituent of a liquid crystal constituent, and an orientation assistant or you may not be, in a certain case, it is desirable that it is less than [the range of less than / less than / 30wt% / of an initial addition /, i.e., 0.003 - 1.5wt%, or it]. If it exceeds this range, switching of liquid crystal may be checked and it will have an adverse effect on the responsibility of liquid crystal. It may be more desirable for close [some] to be, since an orientation assistant will adsorb the impurity in liquid crystal or will contribute to stabilization of orientation depending on the case, if it is below this range. In order to raise the surface energy of a glass substrate, it is effective to perform activation on the surface of a glass substrate, for example, it is effective, to perform UV irradiation processing or to perform chemical preparation, such as silanizing, at the temperature of 250 degrees C or less. [performing heat-treatment of 1 hour] Induction of the increment in the adsorption area by the increment in irregularity with a detailed glass substrate front face, buildup of activation energy, generating of a radical, etc. is carried out by these processings, and an orientation assistant becomes possible [causing an interaction more firmly with the front face of a glass substrate].
[0022] And it is made to harden, where the liquid crystal constituent 7 and the orientation assistant 6 are separated and orientation of the orientation assistant 6 which stuck to the front face of glass substrates 1 and 5 by irradiating the beam of light of predetermined wavelength at an angle of predetermined is carried out along an one direction as shown in (d) of drawing 1 .
[0023] namely, the beam of light which contained the wavelength which this orientation assistant hardens, for example, ultraviolet rays, after enclosing the liquid crystal constituent which made photoresist polymeric materials the orientation assistant and contained this orientation assistant as the technique of changing to the rubbing method which was being performed conventionally, in order to have put the liquid crystal molecule in order in the fixed direction -- an exposure -- an orientation assistant is hardened by things. At this time, by irradiating a beam of light from a predetermined include angle to the front face of the glass substrate of a liquid crystal cell, it becomes possible to have a fixed include angle and to harden an orientation assistant, and it becomes possible to obtain a fixed pre tilt angle. In addition, in order to arrange a liquid crystal molecule in an one direction with directivity as a beam of light to irradiate, the polarization ultraviolet rays which have the plane of polarization of an one direction are more more effective. However, if a beam of light is irradiated at the include angle near parallel to a glass substrate, since the beam of light which will reflect on the surface of a glass substrate, and will not carry out incidence into a liquid crystal constituent will come to occupy most, it is necessary to irradiate from across to some extent.
[0024] As wavelength of a beam of light including ultraviolet rays, it is desirable that the reinforcement of full wave length contains the wavelength of 180nm - 400nm 30% or more. Moreover, the dose to a glass substrate is 300 mJ/cm2 - 8000 mJ/cm2. It is desirable. Since it may become insufficient in the dose not more than this hardening an orientation assistant and a damage may arise in a liquid crystal constituent or a glass substrate in the dose beyond this, it is not desirable.
[0025] A liquid crystal display component is manufactured according to the above processes.
[0026] As mentioned above, according to the manufacture approach of this liquid crystal display component, the liquid crystal constituent with which the orientation assistant which forms the orientation film was mixed is enclosed. Since the orientation film is formed by an orientation assistant being stable in the condition of having adsorbed, on the surface of a glass substrate, and stiffening an orientation assistant after this The process which performs the process and rubbing processing which form the orientation film in two glass substrates, respectively becomes unnecessary, and while being able to control generating of the defect by the dust resulting

from a rubbing process, it becomes possible to reduce a routing counter required for formation of the orientation film. For this reason, it can improve, and the cutback of manday can do the manufacture yield, and it becomes possible to improve productivity.

[0027] The example of the liquid crystal display component manufactured by the manufacture approach which was mentioned above below is explained.

[0028] (Example 1) An example of the liquid crystal display component which applied to below, the vertical orientation mode, i.e., the VAN (VerticalAligned Nematic) mode, concerning an example 1, is explained.

[0029] (a) of drawing 2 and (b) are drawings showing an example of the structure of the liquid crystal display component which applied VAN mode, (a) of drawing 2 shows the condition at the time of no electrical-potential-difference impressing, and (b) of drawing 2 shows the condition at the time of electrical-potential-difference impression.

[0030] Namely, as this liquid crystal display component was shown in (a) of drawing 2 , and (b) A glass substrate 12, i.e., an opposite substrate, equipped with the transparent electrode 10 as a counterelectrode formed of ITO, It has the liquid crystal constituent 19 containing the orientation assistant pinched between the opposite substrate 12 and the array substrate 18, a glass substrate 18, i.e., an array substrate, equipped with the transparent electrode 14 as a pixel electrode formed of ITO, and the TFT driver element 16 as a switching element.

[0031] The opposite substrate 12 sets the predetermined gap prescribed that a counterelectrode 10 counters the pixel electrode by the side of the array substrate 18 by the spacer 21, and is arranged. As shown in the counterelectrode 10 of the opposite substrate 12 at drawing 3 , the slit 20 of about 5-micrometer width of face is formed in the location corresponding to the pixel electrode 14. The TFT driver element 16 is electrically connected to the pixel electrode 14 with a pixel size of 100x300 micrometers. In addition, the screen size of the direction of a vertical angle of this liquid crystal display component is 10.4 inches.

[0032] On the front face 10 by the side of the opposite substrate 12, i.e., a counterelectrode, and the front face of the array substrate 18 with which the pixel electrode 14 and the TFT driver element 16 were formed, the orientation assistant which consists of photo-curing mold polymeric materials adsorbs, and the orientation film 22 formed by hardening where directivity is given in the predetermined direction is formed. In this VAN mode, in order to carry out orientation to a perpendicular direction parallel to the normal of a glass substrate at the time of no electrical-potential-difference impressing as showed the liquid crystal molecule 24 contained in the liquid crystal constituent 19 to (a) of drawing 2 , i.e., off, orientation of the orientation film 22 is carried out so that a pre tilt angle may become 90 abbreviation. And along with a slit 20, the tilt rise of the liquid crystal molecule 24 contained in the liquid crystal constituent 19 at the time of electrical-potential-difference impression, i.e., on, as shown in (b) of drawing 2 is carried out.

[0033] The liquid crystal display component in VAN mode which was mentioned above is manufactured as follows.

[0034] That is, the opposite substrate 12 with which the counterelectrode 10 which has a slit 20 was formed, and the array substrate 18 with which the pixel electrode 14 and the TFT driver element 16 were formed are prepared. And on the front face of the array substrate 18, as a spacer, the spherical particle micro pearl SP of 4-micrometer particle size (Product made from the Sekisui Fine chemical) is sprinkled by the dry type sprinkling method so that 100 spraying consistencies /may be set to 2 mm. And after forming a sealing compound in the front face of the array substrate 18 by screen-stencil except for the inlet which pours in the liquid crystal constituent 19, it is made to rival so that the front face of the array substrate 18 may counter the counterelectrode 10 of the opposite substrate 12, and a liquid crystal cell is produced. At this time, the gap specified by the spacer 21 is formed between the opposite substrate 12 and the array substrate 18. In addition, the sealing compound used here is XN-21 (Mitsui Toatsu Chemicals, Inc. make) which is a 1 liquid epoxy resin.

[0035] and the photo-curing mold acrylic resin which uses the acrylic resin as an orientation assistant as a principal component at this liquid crystal cell -- 0.5wt(s)% -- liquid crystal constituent ZLI-2806 (E. product made from Merck) 19 which have the included negative dielectric anisotropy are poured in by the vacuum pouring-in method. This orientation assistant mainly absorbs and hardens ultraviolet rays.

[0036] After pouring in the liquid crystal constituent 19, a liquid crystal constituent is enclosed between the array substrate 18 and the opposite substrate 12 by closing an inlet in ultraviolet-rays hardening resin UV-1000 (Sony Chemicals Make).

[0037] And after pouring in a liquid crystal constituent, by leaving it, each substrate side is adsorbed with each affinity of the opposite substrate 12 and the array substrate 18, and the orientation assistant currently distributed in the liquid crystal constituent 19 is stabilized, after the orientation assistant and the liquid crystal constituent have dissociated.
[0038] They are 2 J/cm2 to the liquid crystal cell left for 8 hours after pouring in a liquid crystal constituent by the black light which irradiates [of the opposite substrate 12 and the array substrate 18] from a normal the ultraviolet rays which contain 70% of full wave length reinforcement for the wavelength of 180-400nm. Ultraviolet rays are irradiated with a dose. The orientation assistant which consists of photo-curing mold acrylic resin which is sticking to the front face of the opposite substrate 12 and the array substrate 18 by this is hardened. At this time, the orientation film 22 which carries out vertical orientation of the liquid crystal molecule contained in a liquid crystal constituent is formed by irradiating the ultraviolet rays which stiffen photo-curing mold acrylic resin from a vertical direction to the front face of the opposite substrate 12 and the array substrate 18.
[0039] The liquid crystal display component to which VAN mode was applied was manufactured through the above production processes.
[0040] The polarizing plate has been arranged so that it may become a normally black display for this liquid crystal display component, and uniform orientation was obtained, when the electrical potential difference was impressed and the orientation of liquid crystal was investigated. Moreover, when this liquid crystal display component was driven, the almost uniform high-definition display image was obtained.
[0041] (Example 2) An example is explained to the liquid crystal display component which applied the VAN mode concerning an example 2 to below. Although this liquid crystal display component is the same structure as the liquid crystal display component concerning the example 1 shown in (a), (b), and drawing 3 of drawing 2 , a part of production processes differ.
[0042] That is, in the production process of the liquid crystal display component concerning an example 2, after preparing the opposite substrate 12 with which the counterelectrode 10 which has a slit 20 was formed in the front face, and the array substrate 18 with which the pixel electrode 14 and the TFT driver element 16 were formed in the front face, activation of the front face of the opposite substrate 12 and the array substrate 18 is carried out.
[0043] That is, they are the ultraviolet rays which include beforehand the front face of the prepared opposite substrate 12 and the array substrate 18 for the wavelength of 195nm 500 mJ/cm2 It irradiates. By performing such activation, the surface energy of a substrate is raised and the interaction between the orientation assistants and substrates which are contained in the liquid crystal constituent poured in behind increases. By this, stabilization with a liquid crystal constituent and an orientation assistant is promoted, it becomes possible to make an orientation assistant stick to a substrate front face promptly, and separation of an orientation assistant and a liquid crystal constituent can be promoted.
[0044] And the opposite substrate 12 and the array substrate 18 which were activated are assembled like an example 1, and a liquid crystal cell is produced. And the liquid crystal constituent 19 containing the photo-curing mold acrylic resin as an orientation assistant is poured in and left from an inlet. In this case, since activation had been beforehand performed to the opposite substrate 12 and the array substrate 18 before assembling a liquid crystal cell, the orientation assistant and the liquid crystal constituent dissociated in about 1 hour after liquid crystal constituent impregnation.
[0045] And ultraviolet rays are irradiated on the same conditions as the case of an example 1, an orientation assistant is stiffened, and the orientation film 22 is formed.
[0046] Thus, the liquid crystal display component in VAN mode was produced.
[0047] The polarizing plate has been arranged so that it may become a normally black display for this liquid crystal display component, and uniform orientation was obtained, when the electrical potential difference was impressed and the orientation of liquid crystal was investigated. Moreover, when this liquid crystal display component was driven, the almost uniform high-definition display image was obtained.
[0048] (Example 3) An example of the liquid crystal display component which applied the OCB (Optical CompensatedBend) mode concerning an example 3 to below is explained.
[0049] Drawing 4 is drawing showing roughly an example of the structure of the liquid crystal display component which applied OCB mode.
[0050] That is, this liquid crystal display component has the liquid crystal constituent 34 containing the

orientation assistant pinched between the opposite substrate 30 and the array substrate 32, a glass substrate 32, i.e., an array substrate, equipped with the pixel electrode and TFT driver element which were formed of ITO, a glass substrate 30, i.e., an opposite substrate, equipped with the counterelectrode formed of ITO, as shown in drawing 4 .

[0051] The opposite substrate 30 sets the predetermined gap prescribed that a counterelectrode counters the pixel electrode by the side of the array substrate 32 by the spacer, and is arranged. The TFT driver element is electrically connected to the pixel electrode with a pixel size of 100x300 micrometers. In addition, the screen size of the direction of a vertical angle of this liquid crystal display component is 10.4 inches.

[0052] On the front face by the side of the opposite substrate 30, i.e., a counterelectrode, and the front face of the array substrate 32 with which the pixel electrode and the TFT driver element were formed, the orientation assistant which consists of photo-curing mold polymeric materials adsorbs, and the orientation film 36 formed by hardening where directivity is given in the predetermined direction is formed. In this OCB mode, in order that the orientation film 36 may carry out spray orientation of the liquid crystal molecule 38 contained in the liquid crystal constituent 34 in the same flat surface 40 at the time of no electrical-potential-difference impressing, i.e., off, orientation of it is carried out in the parallel direction along the flat surface 40.

[0053] Drawing 5 is the sectional view showing roughly the cross section which cut the liquid crystal display component shown in drawing 4 at the flat surface 40. In this example, the pre tilt angle of the liquid crystal molecule 38 is about 21 degrees.

[0054] And if an electrical potential difference is impressed to the liquid crystal display component in this OCB mode, as shown in drawing 4 , the liquid crystal molecule 38 of spray orientation will be transferred to bend orientation in the same flat surface 40.

[0055] The liquid crystal display component in OCB mode which was mentioned above is manufactured as follows.

[0056] That is, the opposite substrate 30 with which the counterelectrode was formed, and the array substrate 32 with which the pixel electrode and the TFT driver element were formed are prepared.

[0057] And a spacer is sprinkled on the front face of the array substrate 32. And after forming a sealing compound in the front face of the array substrate 32 except for the inlet which pours in the liquid crystal constituent 34, it is made to rival so that the front face of the array substrate 32 may counter the counterelectrode of the opposite substrate 30, and a liquid crystal cell is produced. At this time, the gap specified by the spacer is formed between the opposite substrate 30 and the array substrate 32.

[0058] and the photo-curing mold epoxy resin which uses the epoxy resin as an orientation assistant as a principal component at this liquid crystal cell -- 2wt(s)% -- liquid crystal constituent ZLI-4801-100 (E. product made from Merck) 34 which have the included forward dielectric anisotropy are poured in. This orientation assistant mainly absorbs and hardens ultraviolet rays. The thickness of the liquid crystal layer 34 is 8 micrometers.

[0059] After pouring in the liquid crystal constituent 34, an inlet is closed with ultraviolet-rays hardening resin, and a liquid crystal constituent is enclosed between the array substrate 18 and the opposite substrate 12.

[0060] And after pouring in a liquid crystal constituent, by leaving it, each substrate side is adsorbed with each affinity of the opposite substrate 30 and the array substrate 32, and the orientation assistant currently distributed in the liquid crystal constituent 34 is stabilized, after the orientation assistant and the liquid crystal constituent have dissociated.

[0061] It is 2 4J/cm to the liquid crystal cell left for 8 hours after pouring in a liquid crystal constituent by the black light which irradiates the ultraviolet rays which contain 80% of full wavelength reinforcement for the wavelength of 180-400nm. Ultraviolet rays are irradiated with a dose. At this time, as shown in drawing 4 , ultraviolet rays are the directions of an include angle to which it inclined 45 degrees to the direction of a normal of the opposite substrate 12 and the array substrate 18, and are irradiated from the directions A and B which are on the same straight line and serve as reverse sense mutually by the array substrate and opposite substrate side. The orientation assistant which consists of a photo-curing mold epoxy resin which is sticking to the front face of the opposite substrate 30 and the array substrate 32 by this is hardened.

[0062] Thus, the orientation film 22 with which the pre tilt angle of the liquid crystal molecule 38 contained in the liquid crystal constituent [/ near the front face of the opposite substrate 30 and the array substrate 32] 34 becomes about 21 degrees is formed by irradiating the ultraviolet rays which stiffen a photo-curing mold epoxy resin from the directions A and B to which it inclined 45 degrees to the normal of the opposite substrate 12 and

the array substrate 18 as shown in drawing 5 .
[0063] Thus, the polycarbonate phase contrast plate 42 by NITTO DENKO CORP. is made to rival on the outside surface of the opposite substrate 30 as a biaxial optical compensation film, in the obtained liquid crystal cell, so that it may intersect perpendicularly with the direction where the direction where the refractive index is the largest irradiated ultraviolet rays.
[0064] And polarizing plates 44 and 46 are made to rival so that the outside surface of the array substrate 32 and the outside surface of the biaxial optical compensation film 42, and a polarization shaft may cross at right angles mutually, and the direction of the start of the liquid crystal molecule 38, bearing where the refractive index of the biaxial optical compensation film 42 is the largest, and the include angle of 45 degrees may moreover be made.
[0065] The liquid crystal display component to which OCB mode was applied was manufactured through the above production processes.
[0066] When the electrical potential difference of 4V was impressed to this liquid crystal display component, it transferred from spray orientation to vent orientation promptly. even if it lowers to 1.7V after that -- a vent array -- maintaining -- the orientation of a liquid crystal molecule -- almost -- the whole surface -- uniform orientation was obtained. Moreover, when this liquid crystal display component was driven, the almost uniform high-definition display image was obtained.
[0067] In addition, when the residual concentration of the photo-curing mold epoxy resin in the liquid crystal constituent contained in this liquid crystal display component was investigated, it was 11% of the added amount.
[0068] (Example 4) An example of the liquid crystal display component which applied TN mode concerning an example 4 to below is explained.
[0069] Drawing 6 is drawing showing roughly an example of the structure of the liquid crystal display component which applied TN mode.
[0070] That is, this liquid crystal display component has the liquid crystal constituent 60 containing the orientation assistant pinched between the opposite substrate 52 and the array substrate 58, a glass substrate 58, i.e., an array substrate, equipped with the pixel electrode 54 and the TFT driver element 56 which were formed of ITO, a glass substrate 52, i.e., an opposite substrate, equipped with the counterelectrode 50 formed of ITO, as shown in drawing 6 .
[0071] The opposite substrate 52 sets the predetermined gap prescribed that a counterelectrode 50 counters the pixel electrode 54 by the side of the array substrate 58 by the spacer 62, and is arranged. The TFT driver element 56 is electrically connected to the pixel electrode 54 with a pixel size of 100x300 micrometers. In addition, the screen size of the direction of a vertical angle of this liquid crystal display component is 10.4 inches.
[0072] On the front face 50 by the side of the opposite substrate 52, i.e., a counterelectrode, and the front face of the array substrate 58 with which the pixel electrode 54 and the TFT driver element 56 were formed, the orientation assistant which consists of photo-curing mold polymeric materials adsorbs, and the orientation film 64 formed by hardening where directivity is given in the predetermined direction is formed. In this TN mode, in order that the orientation film 64 may carry out torsion orientation of the liquid crystal molecule 66 contained in the liquid crystal constituent 60 to the opposite substrate 52 side 90 degrees from the array substrate 58 side at the time of no electrical-potential-difference impressing, i.e., off, orientation of it is carried out in the direction which intersects perpendicularly mutually by the array substrate 58 and opposite substrate 52 side.
[0073] The liquid crystal display component in TN mode which was mentioned above is manufactured as follows. That is, after preparing the opposite substrate 52 with which the counterelectrode 50 was formed, and the array substrate 58 with which the pixel electrode 54 and the TFT driver element 56 were formed, activation of the front face of the opposite substrate 52 and the array substrate 58 is carried out.
[0074] Namely, the front face of the prepared opposite substrate 52 and the array substrate 58 is beforehand heat-treated at 180 degrees C for 1 hour. By performing such activation, the surface energy of a substrate is raised and the interaction between the orientation assistants and substrates which are contained in the liquid crystal constituent poured in behind increases. By this, stabilization with a liquid crystal constituent and an orientation assistant is promoted, it becomes possible to make an orientation assistant stick to a substrate front face promptly, and separation of an orientation assistant and a liquid crystal constituent can be promoted.
[0075] And a spacer 62 is sprinkled on the front face of the array substrate 58. And after forming a sealing

compound in the front face of the array substrate 58 except for the inlet which pours in the liquid crystal constituent 60, it is made to rival so that the front face of the array substrate 58 may counter the counterelectrode 50 of the opposite substrate 52, and a liquid crystal cell is produced. At this time, the gap specified by the spacer 62 is formed between the opposite substrate 52 and the array substrate 58.

[0076] and the photo-curing mold polyimide resin which uses the polyimide resin as an orientation assistant as a principal component at this liquid crystal cell -- the chiral agent of 1wt% and a left twist -- 0.1wt(s)% -- liquid crystal constituent ZLI-4792 (E. product made from Merck) 34 which have the included forward dielectric anisotropy are enclosed and left. This orientation assistant mainly absorbs and hardens ultraviolet rays. The thickness of the liquid crystal layer 60 is 5 micrometers.

[0077] Since activation had been beforehand performed to the opposite substrate 52 and the array substrate 58 before assembling a liquid crystal cell, the front face of the opposite substrate 52 and the array substrate 58 was adsorbed in the orientation assistant in about 2 hours after liquid crystal constituent impregnation, and after the orientation assistant and the liquid crystal constituent had dissociated, it stabilized.

[0078] It is 2 4J/cm to the liquid crystal cell left for 2 hours after pouring in a liquid crystal constituent by the black light which irradiates the ultraviolet rays which contain 80% of full wave length reinforcement for the wavelength of 180-400nm. Ultraviolet rays are irradiated with a dose. At this time, ultraviolet rays are irradiated from the directions C and D used as the sense which intersects perpendicularly mutually superficially, when a liquid crystal display component is seen from an observation side side as were shown in drawing 8 , and it is the direction of an include angle to which it inclined 50 degrees to the direction of a normal of the opposite substrate 12 and the array substrate 18 and was shown in drawing 7 . The orientation assistant which consists of photo-curing mold polyimide resin which is sticking to the front face of the opposite substrate 52 and the array substrate 58 by this is hardened.

[0079] Thus, the orientation film 64 with which the pre tilt angle of the liquid crystal molecule 66 contained in the liquid crystal constituent [/ near the front face of the opposite substrate 52 and the array substrate 58] 60 becomes about 13 degrees is formed by irradiating the ultraviolet rays which stiffen photo-curing mold polyimide resin from the directions C and D to which it inclined 50 degrees to the normal of the opposite substrate 52 and the array substrate 58, as shown in drawing 7 and drawing 8 .

[0080] Thus, polarizing plates 68 and 70 are arranged so that it may become no MARIHOWAI and a display on the outside surface of the opposite substrate 52 of the obtained liquid crystal cell, and the array substrate 58.

[0081] When the orientation of the liquid crystal of this liquid crystal display component was investigated, 90 degrees of uniform orientation of TN were obtained. When this liquid crystal display component was driven, the almost uniform high definition display was obtained.

[0082] In addition, although this invention touched on only the liquid crystal display component which used TFT, it cannot be overemphasized that the effectiveness which was excellent even if applied to the active-matrix mold liquid crystal display component using MIM etc. is acquired.

[0083] Moreover, although the display mode also touched on VAN mode, OCB mode, and TN mode, while being vertically arranged by one IPS (In -Plane Switching) mode [in which a liquid crystal molecule is driven to a glass substrate using horizontal horizontal electric field], and glass substrate side, it cannot be overemphasized that it is applicable to various display modes, such as HAN (Hybrid Aligned Nematic) mode in which the liquid crystal molecule arranged by parallel by the glass substrate side of another side is driven.

[0084]

[Effect of the Invention] As explained above, according to this invention, the liquid crystal display component which raises the yield while reducing the number of production processes, and can improve productivity, and the manufacture approach of this liquid crystal display component can be offered.

[Translation done.]